National Imagery and Mapping Agency

The National Imagery Transmission Format Standard (NITFS) Five Year Program Plan

1 JULY 1998

Version 1.0

Foreword

1. The National Imagery Transmission Format Standard (NITFS) is the suite of standards for formatting digital imagery and imagery-related products and exchanging them among the Department of Defense (DOD), other Intelligence Community (IC) members, and other United States (US) Government departments and agencies. Resulting from a collaborative US Government and industry effort, it is the common standard used to exchange and store files composed of images, symbols, text, and associated data.

2. This five year strategic plan describes the current NITFS baseline and the road it is taking to migrate from a suite of DOD standards to a suite of commercially accepted, International Standards (IS) and International Standardized Profiles (ISP). It introduces the improved support that will be provided to imagery and geospatial data users as technologies advance along with operational requirements.

3. NITFS development, technical review, community coordination, and planning is accomplished by the NITFS Technical Board (NTB) and its Format (FWG), Bandwidth Compression (BCWG), and Communications (CWG) Working Groups. The NTB is a consensus-based government/industry forum that responds to the Geospatial and Imagery Standards Management Committees (GSMC and ISMC). The GSMC and ISMC manage geospatial and imagery standards for the DOD and IC encompassed by the US Imagery and Geospatial Information System (USIGS).

4. This plan will be revised annually allowing users time to assess the impacts of proposed changes and budget for required changes. Beneficial comments and pertinent data which may be used to improve this plan should be addressed to Danny Rajan at the National Imagery and Mapping Agency (NIMA), Standards and Interoperability Division, MS P-24, 12310 Sunrise Valley Drive, Reston, VA 20191-3449, electronic mail, rajans@nima.mil, voice (703) 262-4416.

EFFECTIVE PAGE LOG

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12	TBR02	Effectivity for USIGS implementation of NITFS-2003 Baseline
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1.0 SCOPE

This plan defines the NITFS-1994, -1998, and -2003 baselines. It establishes a five year plan to transition from the current DOD standard suite (NITFS-1994) to an IS and ISP suite (NITFS-2003). It addresses NITFS activities within the North Atlantic Treaty Organization (NATO) and the International Organization for Standardization (ISO). Lastly, it addresses emerging standards and activities for future baselines.

1.1 Purpose

This plan's purpose is to aid program managers and non-technical persons that will upgrade from NITFS-1994 baseline implementations to future NITFS baselines and for parties that will implement NITFS for the first time. Technical specifications and implementation requirements are referenced.

1.2 Applicability

This plan applies to DOD, IC, and NATO NITFS users (decision makers, program managers and offices, developers, commercial vendors) that need to electronically exchange imagery with NITFS providers and consumers. (Note: NITFS migration impacts users currently beyond NIMA's budgetary control.)

2.0 REFERENCES

2.1 Department of Defense Standards and Handbook

MIL-STD-2500A	National Imagery Transmission Format (Version 2.0) for the National Imagery Transmission Format Standard, 12 October 1994 with Notice 1, 7 February 1997 and Notice 2, 26 September 1997
MIL-STD-2500B	National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard, 22 August 1997
MIL-STD-188-196	Bi-Level Image Compression for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 27 June 1996
MIL-STD-188-198A	Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard, 15 December 1993 with Notice 1, 12 October 1994 and Notice 2, 14 March 1997
MIL-STD-188-199	Vector Quantization Decompression for the National Imagery Transmission Format Standard, 27 June 1994 with Notice 1, 27 June 1996
MIL-STD-2301	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 12 October 1994
MIL-STD-2301A	Computer Graphics Metafile (CGM) Implementation Standard for the National Imagery Transmission Format Standard
MIL-STD-2045-44500	Tactical Communications Protocol 2 (TACO2) for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 29 July 1994 and Notice 2, 27 June 1996
MIL-STD-188-197A	Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) Compression Algorithm for the National Imagery Transmission Format Standard, 12 October 1994
MIL-STD-2411	Raster Product Format, 5 October 1994
MIL-STD-2411-1	Registered Data Values for Raster Product Format, 30 August 1994
MIL-STD-2411-2	Integration of Raster Product Format Files into the National Imagery Transmission Format, 26 August 1994
MIL-HDBK-1300A	National Imagery Transmission Format Standard (NITFS), 12 October 1994

(Copies of the above standards and handbook are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Other Department of Defense Publication

DOD/JTA V2.0	Department of Defense Joint Technical Architecture Version 2.0, March 1998

(Copies of the JTA are available from the Defense Information Systems Agency, Center for Standards, 10701 Parkridge Boulevard, Reston, VA 20191-4353.)

2.3 Joint Chief of Staff Publications

JV2010	Joint Vision 2010, Chairman of the Joint Chiefs of Staff, Office of the Secretary of Defense
CJCSI 6212.01A	Compatibility, Interoperability, and Integration of Command, Control, Communications, Computers, and Intelligence Systems, 30 June 1995

2.4 National Imagery and Mapping Agency Publications

N0105 DRAFT	NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan, NCCB Final Draft, 19 June 1998
NPIAE	NIMA Profile for Imagery Archive Extensions (NPIAE) for the National Imagery Transmission Format Standard (NITFS), 26 September 1997
NSDE/97	National Support Data Extensions (SDE) (Version 1.2) for the National Imagery Transmission Format Standard (NITFS), 13 March 1997
RASG-9606-001	Airborne Synthetic Aperture Radar (SAR) Support Data Extensions (SDE) for the National Imagery Transmission Format (Version 2.0) of the National Imagery Transmission Format Standard, Version 0.9, 20 May 1996
RMAG-9709-001	Visible, Infrared, and Multispectral Airborne Sensor Support Data Extensions for the National Imagery Transmission Format (NITF) of the National Imagery Transmission Format Standard, 25 September 1997

(Copies of the above NIMA publications are available from the National Imagery and Mapping Agency, ATTN: NIMA/SES, MS-P24, 12310 Sunrise Valley Drive; Reston, VA. 20191-3449.)

2.5 Defense Information Systems Agency Publications

JIEO Circular 9002	Requirements Assessment and Interoperability Certification of C4I and AIS Equipment and Systems, 23 January 1995
JIEO Circular 9008	NITFS Certification Test and Evaluation Program Plan, 30 June 1993, with Errata Sheet dated 24 July 1996
NITFS Tag Registry	Official Register of NITFS Tagged Record Extensions, latest update as posted at http://jitc-emh.army.mil/nitf/tag_reg/mast.htm

(Copies of the above documents are available from the Joint Interoperability Test Command, NITFS Test Facility, Building 57305, Fort Huachuca, AZ 85613-7020.)

2.6 NATO Standardization Agreements

STANAG 4545	NATO Secondary Imagery Format

(Copies of NATO documents are available from the Central US Registry, 3072 Army, Pentagon, Washington DC 20310-3072.)

2.7 International Standards

ISO/IEC 12087-5	Information technology - Computer graphics and image processing - Image Processing and Interchange (IPI) - Functional specification - Part 5: *Basic image interchange format (BIIF)*
ISO/IEC 8632-1,2,3,4:1994	Information technology - Computer graphics metafile for the storage and transfer of picture description information - Parts 1 through 4

ISO/IEC 8632:1992	Information technology - Computer graphics metafile for the storage and transfer of picture description information, AMD.1:1994 - Parts 1-4: Rules for profiles
ISO/IEC 10918-1:1994	Information technology - Digital compression and coding of continuous-tone still images: Requirements and guidelines
ISO/IEC 10918-4:1998	Information technology - Digital compression and coding of continuous-tone still images - Part 4: Registration procedures for JPEG profile, APPn marker, and SPIFF profile ID marker

(Application for copies may be addressed to the American National Standards Institute, 13th Floor, 11 West 42nd Street, New York, NY 10036).

3.0 ACRONYMS

ARIDPCM	Adaptive Recursive Interpolated Differential Pulse Code Modulation
BIIF	Basic Image Interchange Format
BWCWG	Bandwidth Compression Working Group (under NTB)
CADRG	Compressed ARC Digitized Raster Graphics
CCITT	International Telegraph and Telephone Consultative Committee
CD	Committee Draft
CGM	Computer Graphics Metafile
CM	Configuration Management
CORBA	Common Object Request Broker Architecture
CTE	Certification, Test, Evaluation
CWG	Communications Working Group (under NTB)
DGIWG	Digital Geographic Information Working Group
DIA	Defense Intelligence Agency
DIGEST	Digital Geographic Information Exchange Standard
DIS	Draft International Standard
DISA	Defense Information Systems Agency
DOD	Department of Defense
DPPDB	Digital Point Positioning Data Base
DSP	Defense Standardization Program
DSPO	Defense Support Project Office
EO	Electro-Optical
FEC	Forward Error Correction
FGDC	Federal Geographic Data Committee
FWG	Format Working Group (under NTB)
GIS	Geographic Information System
GSMC	Geospatial Standards Management Committee
IC	Intelligence Community
IEC	International Electrotechnical Commission
INCA	Intelligence Communications Architecture
IR	Infrared
IS	International Standard
ISMC	Imagery Standards Management Committee
ISO	International Organization for Standardization
ISP	International Standardized Profile
ITU	International Telecommunications Union
JITC	Joint Interoperability Test Command
JPEG	Joint Photographic Experts Group
JTA	Joint Technical Architecture
JTC1	Joint Technical Committee for Information Technology
JV	Joint Vision
MPEG	Motion Pictures Expert Group
NATO	North Atlantic Treaty Organization
NCCB	NIMA Configuration Control Board
NIMA	National Imagery and Mapping Agency

NITF	National Imagery Transmission Format
NITFS	National Imagery Transmission Format Standard
NPIAE	NIMA Profile for Imagery Archive Extensions
NSIF	NATO Secondary Imagery Format
NTB	NITFS Technical Board (under GSMC - ISMC)
OASD	Office of the Assistant Secretary of Defense
OSD	Office of the Secretary of Defense
PMO	Program Management Office
RFC	Request for Change
RPF	Raster Product Format
SAR	Synthetic Aperture Radar
SDE	Support Data Extension
SDTS	Spatial Data Transfer Standard
TACO2	Tactical Communications Protocol 2
TRE	Tagged Record Extension
UAV	Unmanned Aerial Vehicle
UIP	USIGS Interoperability Profile
US	United States
USGS	United States Geological Survey
USIGS	United States Imagery and Geospatial Information System
UTA	USIGS Technical Architecture
VPF	Vector Product Format
VQ	Vector Quantization
WD	Working Draft

4.0 THE NITFS BASELINES – Past, Current, and Future

4.1 Past

4.1.1 NITF Version 1.0 (1984 - 1990)

By 1984, the imagery community identified a need for and initiated development of a standard data format. Their goal was to develop a co-standard that could be added to existing systems and incorporated into new systems during the acquisition process. Although the initiative built NITF 1.0, this initial format was never implemented or fielded. At that point, the Assistant Secretary of Defense for Command Control Communications and Intelligence (ASD(C3I)) officially established an ad hoc group, the NTB, to continue developing, validating, and certifying the format and integrating it into DOD. The Defense Support Project Office (DSPO) co-chaired the NTB with the Intelligence Communications Architecture (INCA) Project Office, which also managed validation, certification, and testing.

4.1.2 NITF Version 1.1 (1989-1994)

The NTB developed NITF 1.1 and in March 1989, the NITF Configuration Control Board (NCCB), chaired by the Office of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (OASD(C3I)), approved NITF 1.1 for implementation. In 1990, INCA sponsored the establishment of a certification test facility in the Washington, DC area. In 1991 the Defense Intelligence Agency (DIA) assumed INCA's responsibilities and the NTB moved testing to the Joint Interoperability Test Center (now called the Joint Interoperability Test Command (JITC)) at Fort Huachuca, Arizona. By March 1992, over thirty system configurations were NITF 1.1 compliant.

4.2 Current

4.2.1 NITF Version 2.0 (NITFS-1994 Baseline, 1994 - 2000)

In 1988, the NTB began addressing problems found with NITF 1.1 giving rise to the development of NITF 2.0. NITF 2.0 includes the Tactical Communications Protocol 2 (TACO2), communications support that enables NITF to be transmitted over tactical circuits. It also includes compression algorithm standards (JPEG, ARIDPCM, Bi-level, VQ), and a computer graphics metafile (CGM) standard. In May 1989, the Committee on Imagery Requirements and Exploitation (COMIREX) chair adopted NITF as the IC secondary imagery transmission standard. In 1991, the Office of the Secretary of Defense (OSD) directed that NITF be documented as a DOD Standard, and its name was changed to the National Imagery Transmission Format Standard (NITFS). By 1994, the NITFS was implemented in a variety of systems that went beyond the "secondary imagery dissemination" capability. Currently, all or components of the suite of standards are or will be implemented by a variety of the USIGS segments defined within the USIGS Interoperability Profile (UIP), baselined to the USIGS Technical Architecture (UTA). These segments include but are not limited to: National, Tactical and commercial primary producers, archive dissemination systems, Unmanned Airborne Vehicles (UAV), digital imagery, geospatial archives and libraries, and commercial satellite vendors. As of March 1997, an estimated 18 commercial vendors have developed NITF compliant systems and approximately 13,000 software licenses have been sold by industry providing commercial NITF 2.0 products.

NITFS-1994 baseline certification test by the JITC shall continue until 31 December 1999 for "new" systems that are requesting testing as NITF 2.0 "ONLY" systems. Existing development and procurement activities that are already scheduled, and produce deliverables after the 31 December 1999 date, are exempt from this provided prior agreement with NIMA SES and the JITC is obtained.

4.2.2 NITFS Version 2.1 (NITFS-1998 Baseline, April 1998 - TBR007)

During recent years, a number of factors drove changes to NITF 2.0. Among these are: NIMA's stand-up, an OSD mandate to select and implement commercial and international standards where possible, user requirements for improved information (imagery, geospatial, or other) fusion, and the increasing need to

share data within and external to DOD and IC systems. NITF 2.1 was developed with extensive coordination among NITFS users within the USIGS community, NATO and Allied Nations, commercial vendors, and groups dealing with related standards and technologies. MIL-STD-2500B (NITF 2.1) was approved by the GSMC - ISMC on 22 August 1997. NIMA N0105, appendix C summarizes the changes to the NITF 2.0 baseline that support NITF 2.1, the NATO Secondary Image Format (NSIF), and the ISO BIIF standardization efforts.

Notice 1 to MIL-STD-2500B has been reviewed by the USIGS community through the Defense Standardization Program (DSP) process, by NATO through the NSIF editors, and the ISO through the BIIF editors. This large scale review has ensured that MIL-STD-2500B[1] is technically aligned with the other two documents, hence, ensuring base interoperability. Additionally, the quality of the document, from the editorial and organizational perspective, has improved considerably through this widespread review by international readers.

The JITC will begin NITFS 2.1 compliance testing in October 1998. Coordination with NIMA PEOs has resulted in scheduling MIL-STD-2500B with Change Notice 1 implementation to be commensurate with USIGS Effectivity 3.0 or around the Spring, 2000 timeframe. The NATO community will begin fielding NSIF systems much earlier, but will most likely not be producing data (as part of their day-to-day operation) until the Early 2000 timeframe. This will provide system developers, Program Management Offices (PMOs), and commercial vendors enough time to make changes to their baselines or procure new products and applications. Some commercial and government NITF programs and users have already begun to implement NITF 2.1. Others will require significant time to assess funding the necessary changes as well as completing the appropriate compliance testing.

4.3 Future

4.3.1 NITFS-2003 Baseline / ISP of BIIF (2003+)

The transition from the NITFS-1998 baseline to the NITFS-2003 baseline will involve a number of technical and procedural changes in terms of configuration management (CM) and migration to a commercially-based and commercially-supported suite of standards. The NITF ISP of BIIF, when developed and approved for use, shall supersede the NITF 2.1 DOD standard and the Vector Quantization (VQ) DOD standard (because VQ is defined in the BIIF). This will signal the migration from the purely DOD standardization process to one tied into commercial standardization processes. As BIIF is adopted by more communities, the potential for greater support by the COTS vendors, beyond the core DOD users, should increase and the long term economic cost to the DOD and IC should decrease.

It is expected that COTS and GOTS vendors will have developed NITF ISP of BIIF implementations sooner than the 2003 baseline date. Some plan to produce applications for the FY1999 timeframe. This will not impact interoperability, since the NSIF ISP of BIIF will ensure backward compatibility with NITF 2.1 and NITF 2.0.

Another key component of this baseline is JPEG2000 that is addressed in section 5.

[1] Notice 1 to MIL-STD 2500B is expected to be approved by the NTB and ISMC in September 1998. Notice 1 aligns NITF 2.1 with NSIF (STANAG 445). The baseline MIL-STD-2500B is inconsistent with STANAG 4545, and hence, requires Notice 1 to maintain interoperability. Similarly, STANAG 4545 Edition 2, to be approved in Fall 1998 by NATO, accomplishes a similar function for NSIF.

5.0 THE NITFS " Roadmap"

Following instructions that are clearly articulated in Joint Vision 2010,

> "***…when conducting future operations. We must find the most effective methods for integrating and improving interoperability with allied and coalition partners"***

NIMA SES has worked closely with NATO (Air Group 4), the NSIF Custodian (SAF AQIJ), and the OPEN SKIES community (coordinated through the Department of State) to ensure interoperability for the future. NIMA SES has also participated in an ongoing effort to develop a commercially viable IS (ISO/IEC IS 12087-5, BIIF) that is based on NITF.

Other nations and communities have displayed significant interest in adopting the basic NITF structure and capabilities as a common format for the exchange of imagery and geospatial information. The approach is for DOD, NATO, and other interested entities (e.g., medical, law enforcement, agriculture) to develop and register ISPs of applicable ISs for use in acquisition and implementation. For the USIGS community, NITF 2.1 (MIL-STD 2500B), will become an ISP of BIIF. For NATO and coalition partners, NSIF (STANAG 4545) will become an ISP of BIIF. For the Open Skies community, the Open Skies ISP of BIIF will become the standard interchange format.

The migration of NITF 2.0 (NITF-1994 Baseline) to the NITF ISP of BIIF (NITF-2003 Baseline) is a first step towards realization of the JV2010 future operational vision.

Another critical standards development that will significantly impact the USIGS and NATO communities is the JPEG2000 compression standard. The ISO is in the process of developing the JPEG 2000 still image compression standard. This development, expected in the year 2000, will improve upon many of the current modes of JPEG compression within a unified system. The performance goals for JPEG 2000 are shown in the table 5-1.

TABLE 5-1. JPEG 2000 Performance Goals.

JEPG 2000 Performance Goal	Applications/Requirements
Superior low bit-rate performance and better performance throughout the Rate distortion curve	Low bandwidth dissemination of imagery: (i.e., World Wide Web, Cellular Phone Com.)
Unified continuous-tone and bi-level compression	Facsimile
Unified lossless and lossy compression	Medical imagery lossless/lossy compression:
Robustness to bit-errors	Communication over noisy channels (i.e., Cellular Phones)
Progressive transmission by pixel accuracy and resolution	Client server relationship, large image databases
Post-compression quantization and parsing options	Trans-code between lossless stored images and lossy disseminated images
Fixed-rate, fixed-size, limited workspace memory	Rate control for limited memory systems (cameras, copiers, facsimile)
Maximum Flexibility, and other goals	The ability to meet many application needs with little impact on the compression algorithm.

An evaluation of commercial technology that encompassed image quality, compression ratio, and feature requirements concluded with the selection of a wavelet based compression as the baseline technology of the JPEG 2000 standard. This technology, developed by the University of Arizona and SAIC, has proven to improve upon many of the compression algorithms used throughout the USIGS. Table 5-2 contains the expected performance of JPEG 2000 technology compared to some existing compression algorithms used currently.

TABLE 5-2. JPEG 2000 Performance for National Imagery within the USIGS.

USIGS Application	Current Bit Rate	Expected Bit Rate with same quality*	Expected Improvements
Storage (IDEX 4.3 DPCM)	4.3 bpp	2.6 bpp	80% increase in imagery storage capacity
Primary Dissemination (2.3 DCT)	2.3 bpp	2.0 bpp	26 % increase in imagery throughput
Primary Dissemination (1.3 DCT)	1.3 bpp	1.0 bpp	46% increase in imagery throughput
NITFS Dissemination (NITFS JPEG DCT)	0.8 bpp (other bit rates not tested)	0.5 bpp	75% increase in imagery throughput

*Based on experiments and IA evaluation of baseline JPEG 2000 technology and current compression systems

It is also expected that interactions between the different dissemination paths will improve in efficiency (locations do not have decompress and recompress with a different algorithm) and quality (not concatenation of compression algorithms).

Again, from JV2010 (page 32),

> "***Since most of the platforms expected to be in service in 2010 are already designed or operational, we will emphasize high leverage, leading edge technology enhancements to increase our capabilities. We will also place greater emphasis on common usage between Services and increase interoperability among the services and multinational partners."***
>
> ***"While we anticipate that some significant improvements in capability may be gained economically, for example through C4I, others will be more difficult to achieve within the budget realities that exist today and will exist into the next century. We anticipate the need to be selective in the technologies we choose, and thus expect continuing assessment and adjustments for affordability as well as for other lessons learned during the implementation process."***

JPEG 2000 appears to be a first start for the DOD/IC to join the commercial drive to define an advanced, wavelet based compression standard. The small investment today in developing this standard and ensuring DOD/IC requirements are clearly supported, will go a long way to meet the vision described in 2010. As architectures such as USIGS, DCGS and FIA are defined and implemented, the volume of data flowing through archive dissemination systems will be tremendous. Clearly, a key technology to enable the warfighter of the future to receive, process and exploit this imagery and geospatial data is JPEG 2000, and its commercial successors. As proprietary and non-standard technologies are investigated, NIMA must ensure that any future compression technology accepted for USIGS integration is aligned into the standardization process to ensure interoperability in the DOD, IC and Joint/coalition environments.

5.1 The Migration Strategy for the NITFS suite to BIIF and JPEG 2000

To effectuate a graceful migration, the NTB defined three NITFS suite baselines: NITFS-1994 Baseline, NITFS-1998 Baseline, and NITFS-2003 Baseline. Section 2.0 introduced each baseline. Table 5-3 and the paragraphs that follow detail the specific standards and requirements for each baseline. USIGS Effectivities for the implementation of the NITFS-1998 has been determined to be USIGS Effectivity 3.0 while the NITFS-2003 baseline has yet to be determined. However, as part of the compliance testing process that ensures NITFS interoperability, the NTB, with the JITC, has defined requirements for all NITFS system developers as to when testing shall begin (or end) for the three baselines.

TABLE 5-3. NITFS Baseline Definitions .

	NITFS-1994 Baseline (Current USIGS Baseline)	*NITFS-1998 Baseline (USIGS EFFECTIVITY E3.0*	*NITFS-2003 Baseline (USIGS EFFECTIVITY TBR02)*
Certification and Compliance Testing Requirements	Testing of "new" NITF 2.0 ONLY systems (systems that support only NITFS-1994 Baseline) will cease on 31DEC98.	Testing of NITFS-1998 Baseline will begin in OCT98 following approval of the "*NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan*" *All NITFS 2.1 systems are required to read/generate NITF 2.0 files to ensure backwards compatibility*	TBR03
Test Program Plan	JIEO 9008, NITFS Certification Test and Evaluation Program Plan, 30 June 1993, with Errata Sheet	N0105, NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan (DRAFT)	TBR03
Format	**NITF 2.0**: MIL-STD 2500A, National Imagery Transmission Format (Version 2.0), 12 October 1994 through Notice 2 *(Notice 3 to be approved SEP98 adds NITF 2.0 support for NIMA Method 4, and Lossless-JPEG compression – Optional, minimally used capability currently. NITF 2.0 through Notice 3 will be "frozen" during the SEP98 NTB. No further changes will be made.)*	**NITF 2.1**: MIL-STD-2500B, National Imagery Transmission Format Version 2.1, 22 August 1997 *(Notice 1 to be approved SEP98 improves NITF fields' definitions to support MSI, Complex Data and " File-Streaming" Header for tactical users; aligns NITF with NSIF to ensure interoperability; harmonizes NITF 2.1 with NSIF ISO BIIF to ensure migration to ISO ISP will have minimal impact.)* ***NITF 2.0*** *with CN3 or later Change Notice*	TBR05 - **BIIF** *(NITFS ISP of ISO/IEC IS 12087-5, Information Technology – Computer graphics and image processing – Image Processing Interchange (IPI) – Functional specification – Part 5: Basic image interchange format (BIIF))*
Compression: *JPEG2000 Wavelet*	N/A	N/A *(In technical development within the ISO and ANSI; Concurrent evaluations of the technology against USIGS imagery sets) (NIMA SES is POC)*	TBR04 *(ISP of the ISO JPEG 2000 Wavelet, mandatory for all NITFS-2003 systems. Will provide compression rate, image quality, and overall performance, SUPERIOR to existing compression standards and algorithms)*
Compression: *Baseline JPEG Lossy*	**JPEG**; MIL-STD-188-198A, Joint Photographic Experts Group (JPEG) Image Compression through Notice 2. (*Mandatory)*	**JPEG**; TBR05 - N0105, Bandwidth Compression Standards and Guidelines Document (DRAFT). *(Mandatory)*	TBR05 - *N0105*

TABLE 5-3. NITFS Baseline Definitions .

	NITFS-1994 Baseline (Current USIGS Baseline)	*NITFS-1998 Baseline (USIGS EFFECTIVITY E3.0*	*NITFS-2003 Baseline (USIGS EFFECTIVITY TBR02)*
Compression: *JPEG Lossless*	Optional Capability that supports specific National customers. *(Optional)*	TBR05 - N0105, Bandwidth Compression Standards and Guidelines Document (DRAFT) *(Optional)*	N0105, *(No expected technical change to N0105 from NITFS-1994.)*
Compression: *Downsampled JPEG* (*Tactical or NIMA method 4 are subsets)*	Optional Capability implemented operationally	*Bandwidth Compression Standards and Guidelines Document (DRAFT) (Mandatory for systems to decompress and unpack Downsampled compressed NITF files.)*	*Bandwidth Compression Standards and Guidelines Document (DRAFT) or* ISO Document TBD *(Performance capability will be satisfied with JPEG2000 Wavelet.*
Compression: *Bi-level*	MIL-STD-188-196, Bi-Level Image Compression with Notice 1	MIL-STD-188-196, Bi-Level Image Compression with Notice 1 *(some expected technical change to standard from NITFS-1994 Baseline)*	TBD *(capability may be satisfied within JPEG2000 Wavelet;*
Compression: *Vector Quantization*	MIL-STD-188-199, Vector Quantization Decompression, with Notice 1	MIL-STD-188-199, Vector Quantization Decompression, with Notice 1	Defined within the NITFS ISP of ISO/IEC IS 12087-5 *(No expected technical change to standard from NITFS-1994)*
Compression: *ARIDPCM* *(For NITF 1.1 ONLY)*	MIL-STD-188-197A, Adaptive Recursive Interpolated Differential Pulse Code Modulation (ARIDPCM) Compression Algorithm	Optional *(Capability to read legacy ARIDPCM compressed files will be optional; specific USIGS segments, Libraries for example, may be required to use this standard to ensure translation capabilities)*	Optional *(Capability to read legacy ARIDPCM compressed files will be optional; specific USIGS segments, Libraries for example, may be required to use this standard to ensure translation capabilities)*
Graphics: *CGM*	MIL-STD-2301, Computer Graphics Metafile (CGM) Implementation Standard with Notice 1	MIL-STD-2301A, Computer Graphics Metafile (CGM) *(An update that fixes problems with MIL-STD 2301, Notice 1, and provides other user-required capabilities)*	ISO/IEC ISP xxxx-Y, Information technology – International Standardized Profile FCG-nnn-Symbology and annotation for maps and imagery (SAMI) *(Will provide far improved graphic support and merge geospatial and intelligence requirements)*
Communications Protocol: *TACO2*	MIL-STD-2045-44500, Tactical Communications Protocol 2 (TACO2) through Notice 2. *Mandatory for full compliance*	MIL-STD-2045-44500, Tactical Communications Protocol 2 (TACO2) through Notice 2. *Mandatory on those systems*	MIL-STD-2045-44500, Tactical Communications Protocol 2 (TACO2) through Notice 2

TABLE 5-3. NITFS Baseline Definitions .

	NITFS-1994 Baseline (Current USIGS Baseline)	*NITFS-1998 Baseline (USIGS EFFECTIVITY E3.0*	*NITFS-2003 Baseline (USIGS EFFECTIVITY TBR02)*
		requiring it.	
Handbook	MIL-HBK-1300A, National Imagery Transmission Format Standard (NITFS)	No longer maintained *(Minimal changes expected due to NIMA funding constraints for development and promulgation.)*	N/A
Program Plan	N/A	NNPP, The National Imagery Transmission Format Standard (NITFS) 5-Year Program Plan (DRAFT) *(To be updated in 6-month increments, as needed.)*	TBD
Additional Capabilities from previous Versions	N/A	Tremendously improved support for MSI and support for HIS Support for additional data types (Complex) With Notice 1 (to be approved in Sept 98), will support interoperability with NATO secondary imagery dissemination systems. Y2K fix and updated Security Fields	Tremendous improvement in compression performance and quality with JPEG2000 wavelet Tremendous improvement in graphics use (support for intel and geospatial users) with CGM SAMI profile Will Harmonize NATO systems and DOD/IC systems with interoperable profile(s) of BIIF.

After BIIF is published by ISO in the Summer 1998 timeframe, the process to register an ISP of BIIF for the NITFS community will begin. This registration and approval process can take six to twelve months. The ISP, as with other NITFS standards documents, will be approved by the ISMC and coordinated with the NIMA NCCB prior to its entry for ISO registration. Following ISO approval, MIL-STD-2500B and STANAG 4545 will be replaced by an ISP of ISO/IEC 12087-5, in terms of documentation, as a core part of the NITFS-2003 baseline. Technically, there will be no, or minimal, impact to existing NITF 2.1 implementations or other NITFS-1998 components. However as user requirements change, it is expected that the ISP to BIIF will be updated as necessary.

The significant number of legacy NITF 2.0 files, which will most likely be maintained in archives for the next five years, dictate the following strategies for the NITF 2.0 to 2.1 (and NITF to BIIF ISP) evolution:

- *There is no intent to develop and register a NITF 2.0 ISP as will be done for NITF 2.1.*
- *The requirement to read and process NITF 2.0 files will continue for an indefinite time; as long as there are large numbers of NITF 2.0 files in existence and required, there will be concurrent requirements to support 2.0 files.*
- *The requirement to generate NITF 2.0 files will continue for as long as there are NITF 2.0 systems that have not yet upgraded to NITF 2.1/BIIF ISP. As a result, NITF 2.1 implementations must continue to support the creation of NITF 2., ensuring interoperability with systems not yet upgraded or libraries/archives holding legacy products for, at least, the next five years.*
- *The existing suite of military standards for the NITFS 2.0 (NITFS 1994-baseline) will continue to be the authoritative procurement and development document for the implementation of NITF 2.0 readers.*

NITF 2.0 support by NITF 2.1 systems is defined in the compliance testing requirements for the NITFS-1998 baseline and, specifically, for NITF 2.1 (documented in draft N0105)

5.2 Upcoming change notices to NITF 2.0 and NITF 2.1

5.2.1 NITF 2.0 Notice 3 (DRAFT)

Notice 3 (Draft) to MIL-STD-2500A is expected to be approved and published in September 1998 following the DSP coordination process. This change will not require any re-certification by systems, nor will it impact interoperability based on the scope of the communities requesting the change.

Notice 3 adds two new optional compression values: " I1" to support the Down-sampled JPEG compression as used within the tactical community (also known as NIMA Method 4), and "C5" to support Lossless-JPEG compression as produced by the National Community. The ability to decompress both of these algorithms is required for compliance in the NITFS-1998 baseline.

Additionally, Notice 3 addresses the impending century rollover problem. All fields that involve representation of dates (which do not include century identification in NITF 2.0) in the NITF 2.0 Header and Subheaders, now include a recommended " fixed" window for translating 2-digit year fields for the 21st century. The recommended translation is that for years between and including "00" to "59" , the century should be decoded as 21st century; for years including "60" to "99" , the century should be decoded as 20th century.

NITF 2.0 will be frozen for any future technical changes following Notice 3 approval in September 1998. New requirements must flow into NITFS-1998, NITFS-2003, or both.

5.2.2 NITF 2.1 Notice 1 (DRAFT)

Notice 1 (Draft) to MIL-STD-2500B is expected to be approved and published in September 1998 following coordination. This change **significantly** updates NITF 2.1 that was published in August 1997. The change

request, submitted by the NSIF Custodian, SAF AQIJ, aligns MIL-STD-2500B with STANAG Edition 2 Study Draft 1. STANAG 4545 Edition 2 is expected to be ratified in the November 1998 timeframe. These parallel activities will harmonize NATO and US DOD standards.

5.3 Legacy components of the NITFS-1994 Baseline - Discussion on ARIDPCM and TACO2

The Adaptive Recursive Interpolated Differential Pulse Code Modulation Image Compression (ARIDPCM), removed as a required compression in the NITFS-1998 Baseline, is now only used for decompressing legacy files (NITF 1.1) that implement it. There is no requirement for systems to support ARIDPCM to obtain certification.

The Tactical Communications Protocol 2 (TACO2) for the NITFS, MIL-STD-2045-44500, establishes the requirements to be met by systems complying with NITFS when using the TACO2 protocol. It defines the protocols and formats that make up TACO2 and addresses issues concerning functional interoperability. Additionally, it provides for TACO2 operation aspects that are not strictly related to interoperability but may affect technical performance or resistance to error. This standard has been a companion to the NITF as a result of the widespread use of NITFS in low bandwidth tactical environments, where communications lines have relatively low bandwidth (i.e., 2400 or 9600 baud) and where noise and interference are significant. As a result, there will continue to be a need for TACO2 implementation within NITFS, whether it is for the NITF 2.1 or BIIF ISP. In essence, the required implementation of the BIIF ISP will not impact users who need TACO2. Until a viable alternative, non-proprietary commercial or international standard is available, the MIL-STD 2045-44500 will continue to be the sole guidance for TACO2 implementation with the NITF/BIIF.

5.4 Bandwidth Compression Standards

The NITFS-1994 baseline defines four specific bandwidth compression standards (shown in table 5-3). No technical changes are expected to the current compression standards defined within NITF 2.0, except for Notice 3 to NITF 2.0[2] that will:

- *Add the optional capability to compress images with the Downsampled JPEG technique (NIMA Method 4) as designated by "I1" in the image compression definition field.*
- *Add the optional capability to compress images with the Lossless JPEG technique as designated by "C5" in the image compression definition field.*

These capabilities are already in production by limited elements of the USIGS, and are required capabilities (for decompression) in the NITFS-1998 baseline for NITF 2.1 systems. However, the 1998 baseline deletes the requirement to support ARIDPCM compressed imagery, except for archived imagery, but include Lossy- and Lossless- JPEG, Downsampled JPEG (NIMA Method 4), VQ and Bi-level as the valid compression techniques. There are also a number of additional compression technologies being investigated in government and international standards fora for future, potential implementation of USIGS BIIF compliant systems, specifically JPEG-2000, JPEG Multi-component, and Complex Data Compression activity.

5.4.1 Bandwidth Compression Standards and Guidelines Document (DRAFT)

The Draft *BWC Standards and Guidelines* documents the various compression requirements of NITFS not documented or are documented in specific interface control documents (such as for Lossless JPEG).

It is expected that this document will be approved by the ISMC, and coordinated with the NCCB. The BWC Standards and Guidelines does not levy any NEW requirements against existing NITF 2.0 systems. Included in the document are topics, such as:

- *Pre- and Post- Processing for 12-bit JPEG currently implemented by national systems*

[2] CN 3 to MIL-STD 2500A, NITF 2.1, is expected to be approved in Sep.. 1998 by the NTB and ISMC

- *Downsampled JPEG (and NIMA Method 4) currently implemented by some tactical systems*
- *The Lossless JPEG standard as implemented currently by some national systems*
- *Additional technical and implementation guidelines to support developers and users.*

Downsampled JPEG is a mechanism to compress NITF imagery at rates approaching 100:1. This is accomplished by sub-sampling the image in both the row and column directions, and creating a file that is as small as one-quarter the original image. This image is then compressed with JPEG, and as a result, generates an image far smaller than would be produced if JPEG was directly applied to the image. However, the quality of this downsampled/compressed imagery is generally poor (depending on the quality of the original image), and hence may not have utility for users who need to exploit or mensurate for detail information. NIMA Method 4 is a specific implementation of the Downsampled JPEG.

The Low-Bit Rate Evaluation for the NITFS, July 30, 1996, documents the methodology followed in developing this algorithm. It is currently fielded by a number of systems, and is an optional capability for the NITFS-1994 Baseline. For the NITFS-1998 Baseline, this capability is required for unpackers (systems must be able to decompress this imagery).

5.4.2 JPEG 2000 Wavelet Compression

JPEG 2000 compression is the title given to the advanced follow-on to the commercially defined and adopted JPEG standard. JPEG 2000 is at “convergence” status within the ISO/IEC community, and NIMA SES is directly participating at these meetings to ensure that the requirements of USIGS and the NITFS community are supported for the future. The objective of convergence is to technically converge upon a final technical solution, in terms of the type of wavelet, additional features of the algorithm, complexity, etc. Additional requirements of this new algorithm include:

- Improved performance (greater compression rates)
- Support Lossless and lossy (over 100:1) compression rates, progressively
- Automatic generation of RRDS sets
- Improved image quality
- Flexibility to support different types of imagery (visible, IR, Multi-component, etc.)
- Ability to support tiling, and very small and large sized imagery

The current schedule of activities for JPEG 2000 is provided below:

- Submission of algorithm contributions SEP97
- Submission of architecture contributions OCT97
- Experimental results and convergence JUL98
- Working Draft to Committee Draft (CD) NOV98
- CD to final CD JUL99
- Submit CD for Draft International Standard (DIS) MAR00
- DIS submitted for International Standard (IS) JUL00
- IS NOV00

Profile development of the JPEG 2000 standard could potentially begin once it is accepted as a Draft International Standard (DIS) in the mid-FY-00 timeframe. As details of the document are available, and schedules are clearly defined, this strategic plan will provide information regarding implementation into the NITFS/BIIF suite of standards.

5.5 Computer Graphics Standards

Graphic data is used in the NITF to annotate imagery with two-dimensional information represented as a Computer Graphics Metafile (CGM). Examples of graphics are circles, ellipses, rectangles, arrows, lines, triangles, logos, unit designators, object designators (ships, aircraft), text, and special characters. A graphic is stored as a distinct unit in the NITF/BIIF file allowing it to be manipulated and displayed nondestructively relative to the images, and other graphics in the file. This standard does not preclude the use of n-dimensional graphics when future standards are developed.

The graphic format is CGM as described in ISO/IEC 8632-1, Information Technology - Computer Graphics Metafile for Storage and Transfer of Picture Description, 1992. The precise tailoring of the CGM standard to NITF is found in MIL-STD-2301. It is expected that an ISP for ISO/IEC 8632-1, for the USIGS / BIIF community, will replace the military standard when it is registered with ISO.

The NITFS-1994 baseline currently requires implementation of MIL-STD-2301, CN1. MIL-STD-2301A fixes a number of problems identified by the NTB and users in the current 2301/CN-1 version. It also adds some additional graphics capabilities that have been requested by users. 2301A will be required for implementation under the NITFS-1998 baseline.

The " SAMI" ISP of the ISO CGM standard significantly increases the capabilities of NITFS Graphics, especially in the inclusion of graphics types needed to support geospatial production. This will impact current 2301 and 2301A implementations due to the increased complexity of the standard. As a result, it is defined within the NITFS-2003 baseline, to provide opportunity for systems to migrate to this updated standard.

5.6 Support Data Extensions (Tagged Record Extensions)

Tagged Record Extensions (also known as Support Data Extensions or "tags" within some communities) are used in NITF, NSIF, and BIIF to provide implementers the flexibility to include value-added data or information about the file or the image(s) within the file. Extensions are necessary to ensure that changing users' requirements can be met beyond the base standard. The NITF design is sensitive to the potential uniqueness of data and requirements for application of the NITF imagery and associated metadata (i.e., for mensuration, report generation, advanced data processing, etc.). Within NIMA, control and registration of proposed extensions to NITF is vested in the JITC as the Executive Agent. A complete description of all currently approved extensions is maintained on the Internet Home Page for the JITC, and is also mirrored on the NIMA/NITFS homepage. An unclassified compendium of Controlled SDEs for NITFS is currently in development to support the growing number of implementers. In addition, a*n effort is underway to determine which, if any, of the controlled tags should be included as part of NITFS certification and compliance*. This effort is under the guidance of the NTB.

5.6.1 Current Extensions

The following are the significant sets of "controlled" NITFS extensions that have been defined since the inception of NITF 2.0. The current philosophy is that NITF extensions are optional for implementation; all readers of NITF files are minimally required to successfully skip past extension data when attempting to read files they cannot process. Implementers of NITF 2.1 should give renewed consideration to whether their customer base would be better served if extensions were more robustly supported. As stated above, this compliance requirement may significantly change such that implementation of some SDEs will be required as part of the general NITF certification and compliance.

5.6.1.1 Profile for Imagery Archive Extensions (NIMA document NPIAE)

The Profile for Imagery Archive Extensions (PIAEs) is used primarily to support the automatic archival and cataloging of imagery products. Any implementation with a requirement to feed imagery files to an imagery archive/library should support these extensions.

5.6.1.2 National Support Data Extension (NIMA document NSDE/97)

The National SDEs provide data necessary for full interpretation and exploitation of national imagery and are jointly controlled by the ISMC and NCCB.

5.6.1.3 Airborne EO/SAR/IR SDE (RASG-9606-001)

The Airborne Electro-Optical (EO), Synthetic Aperture Radar (SAR) Multi-Spectral, and Infrared (IR) SDEs, version 0.9 provide data necessary for the interpretation and exploitation of imagery from airborne collectors.

5.6.1.4 Raster Product Format (MIL-STDs 2411, 2411-1, 2411-2)

The Raster Product Format (RPF) extensions allow for a more robust interpretation and representation of several NIMA geospatial raster products (CADRG and CIB), that are produced in NITF 2.0 format. These tags are not controlled but are only registered based on prior agreements between the former Central Imagery Office and Defense Mapping Agency.

5.6.1.5 DPPDB (MIL-PRF-89034)

Support for the Digital Point Positioning Data Base (DPPDB) extensions are essential for the proper interpretation and use of NITF formatted files produced in DPPDB products. These tags are not controlled but are only registered based on prior agreements between the former Central Imagery Office and Defense Mapping Agency.

5.6.1.6 ICHIPA

As mensuration and geopositional tools proliferate within the USIGS environment and the dissemination and use of NITF image chips continues to expand, the requirement for a “chipping tag” is evident. This tag provides users with the additional metadata required to mensurate on an image chip using applications such as RULER.

5.6.1.7 Commercial Imagery SDE

The commercial SDEs provide data necessary for the cataloging and retrieval of imagery generated by commercial producers. It is expected that, as the SDE matures, additional data will be added to support IA and GI exploitation of commercial imagery. A significant effort has been expended in the alignment of the commercial imagery SDE and the Airborne EO/SAR/IR SDE. There is an ongoing effort to define additional tags to this SDE that support exploitation and mensuration (see below, the Spatial Support Data Extension). It is expected that by late summer 1998, this will be defined. The SSDE is a proposal intended as a mechanism to provide for RPC-like exploitation support data.

5.6.2 Future Extensions

Below are extensions that will significantly improve the capabilities of the NITFS standard. Some of these are in the draft phase and some are listed as registered tags (not formally controlled or standardized by the NTB). The intent is to control these once it is coordinated and baselined by the community.

5.6.2.1 Softcopy History SDE (DRAFT)

This extension provides a legacy record of the processing functions that have been applied to the image, thus providing the user with a description of the state of the image data at any point in the image chain. It is currently specific to national imagery. However, the baseline version is being updated to support a wider range of users and communities. It is expected to be formalized in 4Q 1998 NTB with coordination with the NCCB.

5.6.2.2 Mosaic tagged record extensions (Registered)

The purpose of these tags is to allow creation of an imagery product comprised of multiple images collected at differing times and under differing conditions while preserving meaningful access to the support data from each of the original collection activities. The approach is to list these tags as 'registered only' until

such time that the concept and tag specifications have been proven. Once the specification becomes stable, the intent is to convert the tags to a 'controlled' tag and obtain NTB approval.

5.6.2.3 Geospatial support data extension, GeoSDE (DRAFT)

This SDE is being developed in coordination with NATO, the Digital Geographic Information Working Group (DGIWG), and the ISO TC211 organization. The purpose is to extend the NITFS format so that standard geospatial metadata (for georeferencing) can be included with an NITFS file and is interoperable with the geospatial metadata used by our coalition partners. It is expected to be controlled in 2Q 1999

5.6.2.4 Complex Data SDE

This SDE, under development under the guidance of the Air Force, will facilitate the inclusion of Complex SAR data with NITFS imagery. It is expected to be controlled in the 2Q-1999 timeframe.

5.6.2.5 Spatial SDE (or Common Sensor Model), DRAFT

There is an effort to define a common SDE to support exploitation of commercial and tactical imagery based RPC-like rational functions. It is expected to be controlled in the early FY-1999 timeframe.

5.7 Certification Test And Evaluation Plan

5.7.1 NITFS-1994 Baseline

For NITF 2.0, JIEO Circular 9008 establishes the NITFS Certification Test and Evaluation (CTE) Program for achieving and sustaining NITFS compliance by all fielded and developmental digital imagery systems that require NITFS interoperability. It describes the processes and procedures for obtaining certification of a COTS/GOTS system or application for compliance with the NITFS. It also prescribes NITFS CTE Program policies, defines roles and responsibilities of participating organizations, and provides certification funding guidance.

This document has ensured the community that developers of NITFS systems and applications implement the suite of standards in a similar way, addressing issues of ambiguity or confusion sometimes raised as standards are used and hence, minimizes potential interoperability problems.

5.7.2 NITFS-1998 Baseline

For NITF 2.1, NIMA document N0105 (DRAFT), " NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan" , provides the test program guidance for the implementation, test and fielding of NITF 2.1 systems and applications. This plan describes the processes and procedures for obtaining testing of imagery implementations for compliance with the NITFS 2.1 and for interoperability among systems within the USIGS.

It introduces significantly new requirements for the NITFS-1998 baseline beyond what was required in previous versions of NITF.

5.7.3 NITFS-2003 Baseline

TBR 03

5.7.4 Test Services

Developers and implementers of NITF are encouraged to contact the JITC early in their development cycle. The JITC can: 1) assist with interpreting the implementation requirements for the NITFS, 2) consult in choosing options for implementation, 3) provide sample NITF files to support development of interpret capabilities, 4) provide informal evaluation of files produced to help ensure proper understanding of the standards, and can assist with selected software list tools to assist development efforts.

5.8 Migration Schedule

Figure 5-1 provides the tentative schedule for a ratified IS and profile for BIIF, as well as for the profiles/ISPs of the other standards defined under the NITFS. It is expected that proposed profiles for the BIIF shall be developed and coordinated within the USIGS user community between FY98 and FY00, and will be registered with ISO (as needed).

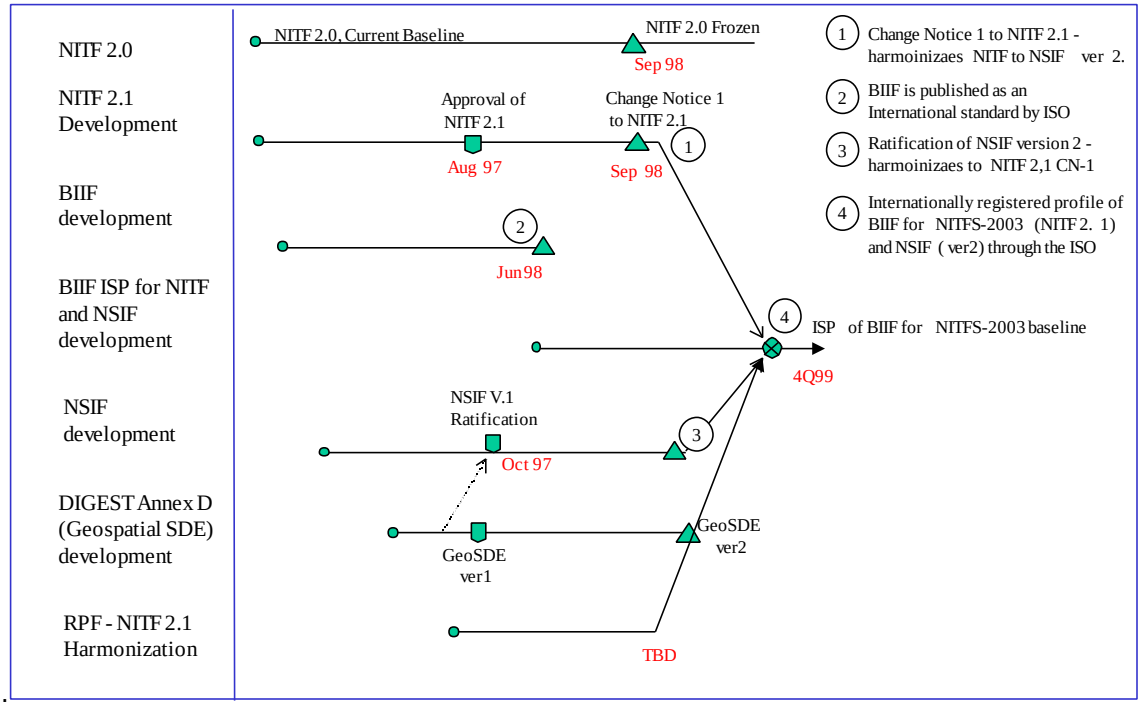

FIGURE 5-1. Tentative Schedule for BIIF IS and USIGS ISP of BIIF.

6.0 EMERGING STANDARDS AND ACTIVITIES FOR FUTURE BASELINES

With technology evolving at an alarming rate, the expansion of the Internet and World Wide Web into areas unexpected just a few years ago, and the OSD mandate of the government to migrate to a COTS based standards environment, there is a clear need to start planning today for the standards of the future. This plan has addressed the short term future as the USIGS community transitions from the NITFS to a suite of international standards and profiles over the 1998 - 2003 timeframe. There is an understanding, however, that the long term path for BIIF needs to be clearly defined over the next few years, so that, when programmatic and procurement windows of opportunity open, the USIGS users and elements can better support the insertion of new technologies and changing standards. Incorporating this evolution requires understanding the USIGS technical architecture today, understanding the requirements of the user in the 2003+ timeframe, and clearly understanding where the commercial market is driving information interchange standards for the 21st century.

This section briefly describes a few activities that are related to the NITFS Program that may result in standards for inclusion into the BIIF suite for the future. Additional activities shall be introduced as this document evolves.

6.1 Multi-Component JPEG

The purpose of this Multi-component JPEG standard, under the leadership of the ISO JTC1/SC29/WG1 organization, is to provide a standard means of compressing and decompressing multiple-component, continuous tone images, in such a way that the reconstructed output has minimal image quality loss with respect to the original image. This standard would be applicable to those users who have imagery that does not subscribe well to the standard color compression techniques commonly used with the current JPEG, such as multi-spectral imagery, medical imagery (MRI, CAT scan), and color imagery.

A primary goal for this algorithm is to maintain compatibility with the procedures defined in ISO 10918-1 in order to maintain some level of backward compatibility to the current JPEG standard. There is an additional objective to develop Multi-component JPEG such that it will become part of the JPEG 2000 architectural framework, and hence avoid having two standards that can potentially support multi-spectral. As JPEG 2000 evolves closer to “convergence” in terms of the core standard, the role of this multicomponent standard will become more evident

6.2 Complex Data Format / Compression

There are several ongoing activities in the area of complex SAR data format standardization and compression that may potentially impact the NITFS community. These involve the definition of requirements to establish a complex data format standard, as well as applicable compression technologies or definition of a standard. Although not a work item in the international standards groups, the DOD/IC is actively addressing this requirement.

6.3 Emerging Container Technologies

Activities in the ISO, Object Management Group (OMG) and the Open GIS Consortium (OGC) are going to force the NITF/BIIF community to look to a new paradigm for how information (not just imagery, but video, audio, graphics, and any other data types) will be exchanged within the USIGS of the future. The evolution to distributed computing environments and new container technologies is focusing on object oriented approaches, such as the Common Request Broker Architecture (CORBA) from the OMG, Java from SUN Microsystems, and Active X from Microsoft. This is an emerging paradigm that will support the data interchange requirements and COTS technologies of the 21st Century. The DOD and IC are actively pursuing mechanisms for migrating from the current paradigm (as is now implemented by NITFS) to the paradigm that the international standards organizations and commercial consortiums are quickly heading toward.

6.4 The Spatial Data Transfer Standard (SDTS) – BIIF Harmonization

Federal mapping agencies are working together toward a convergence of geospatial raster data transmission standards. SDTS Raster Profile with BIIF Extension is being drafted as a Federal Geographic Data Committee (FGDC) work item. The BIIF Geospatial ISP will incorporate the requirements of other US Federal mapping agencies. Initially the US Geological Survey (USGS) and NIMA, to allow open interoperable interchange of data by means of converging standards into a common format. Draft FGDC SDTS Raster Profile with BIIF Extension is an ISO 8211 encoding format to be used for USGS raster and gridded data, including Digital Terrain Elevation Model (DTEM).

ANNEX A: Register of NITFS Compliant Systems and Software

This appendix provides a listing of imagery systems, software, and other components that have been tested and certified as compliant with NITF Standards by the JITC, as the executive agent for NITFS testing for NIMA. This information is based on data received up to June 1998.

The NITFS Certification Test and Evaluation (CTE) Program is composed of the NITFS CTE Facility, policies, procedures, and administrative planning actions required to achieve and sustain an imagery system's compliance with the NITFS through testing. The test program supports both the Department of Defense (DoD) and the Intelligence Community (IC) objectives for ensuring an interoperable format for the exchange of digital imagery products among heterogeneous systems.

All NITFS conformance testing is performed by the JITC at Fort Huachuca, Arizona, within a strict laboratory environment. The objective of NITFS conformance testing is to assess the ability of a system or product to create and output, accept and process, and recognize component parts of NITFS-compliant files. The JITC also performs validation testing of proposed additions to the NITFS and other NITFS-related test activities.

Note: Potential users should review detailed test results to evaluate suitability of these products for intended uses. Optional features within the standards may not be implemented. Product registration and/or system certification does NOT guarantee that the product meets all potential users' fielding requirements.

A.1 NITFS 1994 / NITF 2.0 Baseline Register

A.1.1 NITFS 2.0/TACO2 System Compliance Certification Register

The System Compliance Certification Register identifies imagery systems certified as NITFS compliant IAW JIEO Circular 9008, paragraph 4-1A.

101 Forward Area Support Terminal (FAST)	(Registration Expired)
102 Portable Receive Transmit System (PORTS)-Model 1N (PORTS-1N)	(Registration Expired)
103 Electronic Light Table (ELT) 1000/2000/3000 Rel 2.0, Rev 0	(Registration Expired Superceded by 103B)
103A Electronic Light Table (ELT) 1000/2000/3000 Rel 2.0.1	(Registration Expired Superceded by 103B)
103B Electronic Light Table (ELT) 1000/2000/3000 Rel 2.0.2	
104 NORTHROP View(TM) 3.1	(Registration Expired Superceded by 104B)
104A NORTHROP View(TM) 3.2	
104B NORTHROP View(TM) 3.3 Rel 8	
105 Digital Imagery Exploitation Production System (DIEPS) Rel 5.0	(Registration Expired Superceded by 303A)
106 Joint Maritime Command Information System (JMCIS) Unified Build 2.2.0.5)	(Registration Expired Superceded by 318
107 ERDAS Imagine Ver 8.2	(Registration Expired)

108 PhotoTelesis (ACT-105, ACT-106, MIT-301, SEC 750, PICS)	(Registration Expired Superceded 108A)
108A PhotoTelesis Imaging and Communications Environment (ICE) Rel 2.2	
109 Electronic Light Table (ELT) 7000 Rel 2.0	(Registration Expired Superceded by 109A)
109A Electronic Light Table (ELT) 7000 Rel 3.0.1	
110 Demand Driven Direct Digital Dissemination (5D) System Ver 4.0A (Developmental Release)	(Registration Expired Superceded by 110A)
110A Demand Driven Direct Digital Dissemination (5D) System Ver 4.0 (Production Release)	
110B Demand Driven Direct Digital Dissemination (5D) System Ver 4.0.4	
111 Target Material Workstation (TMWS)	(Registration Expired)
112 Over-The-Horizon (OTH) Airborne Sensor Information System III Tactical Data Processor (OASIS III TDP)	(Registration Expired)
113 Electronic Light Table (ELT) 2500 ImageVIEWER 3.2c Release 1	
113A Electronic Light Table (ELT) 2500PC ImageVIEWER	
114 Joint Deployable Intelligence Support System (JDISS) version 2.0	
115 Electronic Light Table (ELT) 4000 Rev 1.0.0	
116 Over-The-Horizon (OTH) Airborne Sensor Information System III Image Processor (OASIS III IP)	

A.1.2 NITFS 2.0/TACO2 Component Compliance Certification Register

The Component Compliance Register - NITF 2.0/TACO2 - identifies software components supporting both NITF format and TACO2 that have been tested for NITFS compliance IAW JIEO Circular 9008, paragraph 4-1B.

201 Secondary Imagery Dissemination Environment & Resource Manager X-Windows (SIDEARM-X)	(Registration Expired)
202 Secondary Imagery Dissemination Environment & Resource Manager Windows (SIDEARM-W)	(Registration Expired)
203 Joint Services Imagery Processing-Secondary Imagery Dissemination System (JSIP-SIDS) Ver 2E	(Registration extended on 23 Jul 96)

A.1.3 NITFS 2.0 ONLY- Component Compliance Certification Register

The Component Compliance Register - NITF 2.0 only - identifies software components supporting only the NITF 2.0 format that have been tested for NITFS compliance IAW JIEO Circular 9008, paragraph 4-1B.

301 Multi-Source Automatic Target Recognition with Interactive Exploitation (MATRIX) Ver 2.9.3	(Registration Expired)
301A Multi-Source Automatic Target Recognition with Interactive Exploitation (MATRIX) Ver 4.0	
302 Electronic Light Table (ELT) 3000 Rel 2.0, Rev 0	(Registration Expired Superceded by 302C)

302A Electronic Light Table (ELT) 1000/2000/3000 Rel 2.0, Rev 0	(Registration Expired Superceded by 1302C)
302B Electronic Light Table (ELT) 1000/2000/3000 Rel 2.0.1	(Registration Expired Superceded by 302C)
302C Electronic Light Table (ELT) 1000/2000/3000 Rel 2.0.2	(Registration Expired)
303 Digital Imagery Exploitation Production System (DIEPS) Rel 5.0.1-2	(Registration Expired Superceded by 303A)
303A Digital Imagery Exploitation Production System (DIEPS) Rel 5.0.1-3(UNIX-Platforms)	
303B Digital Imagery Exploitation Production System (DIEPS) Rel 5.0.1-3 (Win-NT)	
Over-the-Horizon (OTH) Airborne Sensor Information System (OASIS) III TDP	(Registration Expired)
305 VITec Electronic Light Table Ver 5.0	(Registration Expired Superceded by 305A)
305A VITec Electronic Light Table Ver 5.4, r7.4	
305B VITec Electronic Light Table Ver 5.6	
306 ERDAS Imagine Ver 8.2	(Registration Expired)
307 Point Positioning Production System (PPPS) Build 13	
307A Point Positioning Production System (PPPS) Build 17	
308 Power Image Ver 3.1.0	(Registration Expired)
309 Collection Exploitation Module (CLEM) Software Ver 2.0	
310 Eastman Kodak Digital System (DCS) Software Ver 2.00B1	
311 Modular Dissemination System (MDS) Build 6154	
312 Demand Driven Direct Digital Dissemination (5D) Ver 4.0.3(Sun)	
312A Demand Driven Direct Digital Dissemination (5D) Ver 4.0.3(DEC/HP)	
313 Image Product Archive (IPA) Ver 1.2.2	
313A Image Product Library (IPL) Ver 1	
314 Paragon Imaging ELT/NET Ver 1, Build 4.	
317 Paragon Imaging Global Image Viewer (GIV) rev 1.0.1.	
318 Joint Maritime Command Information System (JMCIS) Unified Build 2.2.0.5, Global Communications and Control System-Maritime (GCCS-M) 3.0.2	

A.1.4 TACO2 ONLY- Component Compliance Certification Register

The Component Compliance Register - TACO2 only - identifies software components supporting only TACO2 that have been tested for NITFS compliance IAW JIEO Circular 9008, paragraph 4-1B.

401 NITF Communications Interface Unit (NCIU)

402 SIDEARM-W Rel 1.04

403 SIDEARM-X Rel 1.1

404 Harris RF3710-001 Protocol Engine Ver 1.5

*A.*1.5 NTB Sample/Demonstration Software *Register*

The NTB Sample/Demonstration Software Register identifies software items that have been tested for compliance IAW JIEO Circular 9008, paragraph 4-1B, for the particular NITFS function supported.

B101 Group III FAX (Bi-level) Rel 7 June 93

B102 Group III FAX (Bi-level) Rel 22 May 95

B103 Group III FAX (Bi-level) Ver 3.0 Rel 5 July 95

C101 CGM for POSIX Ver 2.1.2 Rel 8 August 94

C102 CGM for POSIX Ver 2.2 Rel 8 September 95

J101 NITF JPEG Compression (NJC) Ver 2.2I

J102 NITF JPEG Compression (NJC) Ver 2.4B

J103 NITF JPEG Compression (NJC) Ver 2.4C

J104 NITF JPEG Compression (NJC) Ver 3.0

N101 Multi-Source Intelligence for Analysis, Targeting, and Exploitation (MATE) Ver 2c1 Rel 27 February 95

N102 Multi-Source Intelligence for Analysis, Targeting, and Exploitation (MATE) Ver C2 Rel 8 August 95

N103 Calibration Tool (CalTool) Ver 1.1

S101 SENDS-Windows 2.0 (SENDS-W 2.0) Rel 9 March 95

S101A SENDS-Windows 2.0 (SENDS-W 2.0) Rel 2.0.2 February 96

S102 SENDS-UNIX 2.0 (SENDS-X .0) Rel 9 March 95

S103 SENDS-Windows 2.0.1 (SENDS-W 2.0.1) Rel 25 August 95

T101 TACO2 (DOS) Ver 2.0.1 Rel 24 August 94

T102 TACO2 (UNIX) Ver 1.30 B2 Rel 1 December 93

T103 TACO2 (UNIX) Ver 1.5 B2 Rel 31 January 95

V101 Vector Quantization (VQ) Decompression and Display Rel 15 February 95